

UNITED STATES PATENT OFFICE.

ALADAR PACZ, OF CLEVELAND HEIGHTS, OHIO, ASSIGNOR, BY MESNE ASSIGNMENTS,
TO ALUMINUM COMPANY OF AMERICA, A CORPORATION OF PENNSYLVANIA.

COMPOSITION OF MATTER.

No Drawing.

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To all whom it may concern:

Be it known that I, ALADAR PACZ, a citizen of the United States, residing at Cleveland Heights, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Composition of Matter, of which the following is a full, clear, and exact description.

This invention relates to the successful utilization of alloys containing a material amount, i. e., more than a trace of silicon combined with aluminum, with one or more other metals. Silicon when present in combination with aluminum or any alloy thereof in any proportion above a mere trace, e. g., one-half to three-fourths of one percent, may be deleterious by reason of its tendency to segregate in the form of large crystals, thereby rendering the alloy weak and brittle, especially in the presence of iron; and such is in fact the case when alloys of aluminum and silicon are cast in the usual manner, for which reason great care is exercised and much expense incurred in refining the raw products from which the aluminum is made so as to exclude silicon. It is this silicon problem which has hitherto prevented the employment of clay and other easily available substances as a source of aluminum and has necessitated the use of much more rare and expensive materials, coupled with a careful refining even of those.

If an alloy of aluminum containing from about one percent to about twenty percent of silicon (with or without other metals but preferably containing a preponderance of aluminum), be cast under pressure other than or additional to gravity in metal molds, this segregation is substantially overcome, especially in case the molds are maintained at a temperature considerably below the melting point of the alloy as is generally done for practical reasons. In the process known as "die-casting" the supposedly injurious effect of the silicon is not only overcome but certain decidedly beneficial effects are produced, namely: the molten metal is more fluid and thus fills the molds more easily; the metal shrinks less on setting and contracts less on cooling; and the metal instead of exhibiting a granular consistency at the instant of setting as in many silicon-free aluminum alloys, exhibits a considerable degree of tenacity and elasticity at this

instant. As a combined result of these properties the molds are more easily filled, the castings are more accurate and possess a better finish, there is less cracking in the molds, there is less warping, and it becomes possible to extend the die casting process to much larger articles than heretofore.

Castings made under the conditions described from an alloy of aluminum and silicon, substantially without other ingredients, exhibit a high degree of lightness, tensile strength, and ductility; they can be made more cheaply than other aluminum alloys for the reasons that silicon is generally cheaper than aluminum, that aluminum containing silicon as an impurity is cheaper than pure aluminum, and that the increased fluidity and decreased shrinkage of the metal results in a larger proportion of perfect castings. In cases where lightness is desired the preferred composition is one containing between about 8 percent and about 15 percent of commercial silicon and the remainder aluminum, the former having a 95 percent purity and the latter a 99 percent purity. The most usual impurities in silicon are aluminum and iron, and those in aluminum are silicon and iron, but even if iron constitute the major impurity in both ingredients excellent articles of this alloy are produced by die casting. The tensile strength of such castings is generally upwards of 23,000 pounds per square inch coupled with an elongation upwards of 3 per cent and a specific gravity less than 2.7.

The beneficial effects of silicon are also obtained with the use of smaller amounts of the same, especially in case other ingredients be added to modify the physical characteristics of the resulting alloy; although I prefer to use at least about 2½ per cent of this element. On the other hand the uppermost practical limit of silicon appears to be about 20 per cent. It will be understood, however, that in order to employ such a large proportion of silicon the amount of certain other metals, such as iron, must be kept low; but if the silicon content be sufficiently restricted the range of other metals may be increased thus enabling the use of cheaper grades of silicon. Thus if the silicon content is kept below about 10 per cent I may use "90 percent ferrosilicon."

I do not advocate the use of iron in any

case for its own sake but have merely mentioned it as being a common impurity in silicon which must be reckoned with. However the addition of metals having atomic weights between about 58 and 66 and especially those between 63 and 66 is decidedly advantageous in many cases by reason of the effect upon the physical properties of the alloy in offsetting to some extent the injurious qualities of incidentally present iron. The larger of these definitions includes nickel, zinc, and copper, the smaller includes zinc and copper alone. For die casting purposes wherein a heavier and harder material is desired an excellent alloy can be made using at least 75 per cent of aluminum together with from about 2½ per cent to about 10 per cent of silicon the balance being one or more of the metals last named. Any die casting alloy is esteemed to fall within my invention if it contain at least 50 per cent of aluminum and at least 2½ per cent of silicon, with or without impurity-iron up to about 3½ or 4 per cent; although for practical purposes it is better to use larger proportions of aluminum, namely 75 per cent to about 92 per cent, owing to the fact that it combines in largest degree the qualities of strength and fusibility. As examples of my meaning I may suggest 3 per cent pure silicon, 15 per cent nickel, 82 per cent aluminum; 5 per cent pure silicon, 4 per cent nickel, 91 per cent aluminum; 5 per cent ferrosilicon, 87 per cent aluminum, and 8 per cent of a mixture of zinc and copper; or zinc and nickel, or copper and nickel; or copper, zinc and nickel.

The pressures herein mentioned are preferably those ordinarily used in die casting, namely about 300 to 400 pounds per square inch, although I do not restrict myself thereto owing to the fact that casting in chills has the same tendency and is sufficient for some compositions and especially for small articles which cool quickly. Also I do not limit myself to the use of metal

molds in case future invention should develop molds of other materials which will withstand both the pressure and temperature.

Having thus described my invention what I claim is:

1. A die casting alloy containing nickel between about 2½ per cent and 10 per cent of silicon, and a preponderance of aluminum.

2. A die casting alloy containing between about 2½ per cent and 10 per cent of silicon combined with at least 75% and not over 92% of aluminum and any balance consisting mostly of nickel and one or more metals having atomic weights between 58 and 66.

3. A die casting alloy containing between about 2½ per cent and 8 per cent of silicon, at least about 70% of aluminum and at least about 4% of substances other than silicon and aluminum, such last defined substances including nickel and consisting mostly of metals having atomic weights between 55.5 and 66, and the amount of iron present being not greater than that of silicon nor greater than about 3½% of the whole.

4. A die casting alloy containing at least about 2½ per cent silicon and at least about 82 per cent aluminum, and the balance containing at least about 4 per cent of one or more metals having atomic weights between 55.5 and 66, one of these being nickel and at least one other of such last named metals having an atomic weight between 63 and 66.

5. As an article of manufacture, a die casting containing at least 2½ per cent of silicon and at least 70% of aluminum the balance consisting of a plurality of metals having atomic weights between 55.5 and 66, one of which is nickel and at least one of which is a metal whose atomic weight is between 63 and 66.

In testimony whereof, I hereunto affix my signature.

ALADAR PACZ.